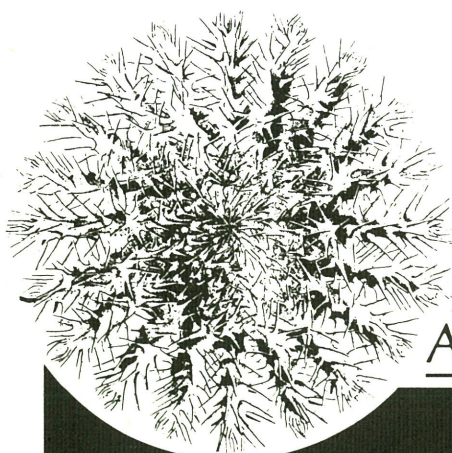


Priorities for Ecological Research in 1987/88:
Recommendations to Technical Subcommittee (COTSARC)

P. Moran, Study Leader



Australian Institute of Marine Science
The Crown-of-thorns Study

Barrier Reef
Crown-of-thorns Study Report 8
MARINE PARK AUTHORITY

May 1987

18 SEP 1991

LIBRARY

Priorities for Ecological Research in 1987/88:
Recommendations to Technical Subcommittee (COTSARC)

P. Moran

*The Library
Great Barrier Reef
Marine Park Authority
P.O. Box 1379
Townsville, 4810*

Crown-of-thorns Study Report 8
Australian Institute of Marine Science
Townsville, 1988

ISBN 0 642 13502 9

Australian Institute of Marine Science, 1988

Copies available from Librarian

PMB No 3, Townsville MC., Queensland 4810

TABLE OF CONTENTS

	PAGE
Introduction	1 - 2
Progress of research	3 - 5
Research proposed for 1987/88	6 - 9
Criteria for the selection of ecological projects	10
Priorities in ecological research: recommendations for 1987/88	11 - 12
References	13
Appendices	14 - 24

INTRODUCTION

During the 1987/88 fiscal year \$505,000 was allocated by the Great Barrier Reef Marine Park Authority (GBRMPA) to support the ecological research which the Australian Institute of Marine Science (AIMS) is coordinating on the crown-of-thorns starfish (termed The Crown-of-Thorns Study). This represented a 23% decrease in the amount that was expected according to a Record of Understanding established between the two institutions in August 1985. A total of \$1.063 million has been given to the Institute since the Study first began in December 1985. A list of the ecological projects which have received funds within the last year and a half is given in Table 1. It will be noted from this Table that many of the projects are on-going and have received financial support from the inception of the Study.

The amount of funds given to each project for the 1986/87 fiscal period was determined by an Assessment Panel which was formulated (by AIMS) at the beginning of 1986 to review the progress of all ecological projects and make recommendations for the funding of future research (The Crown-of-Thorns Study Reports, 1986a). In October 1986 the Assessment Panel recommended that all on-going projects be funded for the 1986/87 fiscal year (The Crown-of-Thorns Study Reports, 1986b). This was decided because it was difficult to assess the performance of most projects, given that many of them had been underway for only a short period of time and most had been proposed to be conducted over a 3-4 year period. In order to meet this recommendation funding cuts were applied equally, where possible, to all projects. These funding cuts were made in consultation with each Chief Investigator and the Study Leader, Dr P. Moran. The amount of funds finally given to each project is listed in Table 1.

Table 1. A list of the ecological projects which have received funds since the Crown-of-Thorns Study first began.

Chief Investigator	Institution	Funds (\$) Allocated
<u>1985/86</u>		
1. Programme	Australian Institute of Marine Science	395,076
2. Hopley	James Cook University	2,000
3. Lucas	James Cook University	19,352
4. Hartwick	James Cook University	5,000
5. James et al.	James Cook University	32,697
6. Endean/Cameron	University of Queensland	22,000
7. Doherty	Griffith University	49,797
8. Parslow/Gabric	Griffith University	4,000
9. Hanna et al.	Deakin University	16,078
10. Harriott/Fisk	Reef Research and Information Services	12,000
	TOTAL	558,000
<u>1986/87</u>		
1. Programme	Australian Institute of Marine Science	378,140
2. James et al.	James Cook University	24,360
3. Lucas	James Cook University	16,000
4. Contract	James Cook University	10,000
5. Endean/Cameron	James Cook University	15,500
6. Doherty	Griffith University	44,000
7. Harriott/Fisk	Reef Research and Information Services	17,000
	TOTAL	505,000

PROGRESS OF RESEARCH

Now that most of the projects have been underway for at least one year the Technical Subcommittee which has taken the place of the Assessment Panel, is in the position of being able to make informed judgements on the progress of each project and the amount of funds that should be allocated to each over the coming year. In general, the progress of the research projects in this Study has been good despite the fact that funds during the present year (1986/87) were cut by approximately 23%. This has led to the cancellation of two projects in the AIMS programme which were due to commence in August last year. A summary of the progress of all projects has been prepared from the reports given in the document submitted to COTSARC (The Crown-of-Thorns Study Reports, 1987) (see Table 2). Several conclusions can be made concerning the progress of research in this Study:

1. Most projects are at the stage where significant results are being produced which have a direct relevance to the main research objectives. Over the past 12-18 months the majority of projects have progressed from a developmental/design phase to a field sampling/analysis phase. It is expected that productivity within the whole Study (in terms of the results produced) will increase greatly during the next year once this latter phase has been completed.
2. Of course not all projects have progressed at the same rate. Those that appear to have lagged behind the others have done so mainly because they have either encountered technical (e.g. equipment failures or computing problems) or logistic (e.g. field sampling problems or inclement weather) difficulties or they have involved extensive preliminary research (e.g. developing suitable sampling techniques). Such preliminary work is often needed in some studies so that the research objectives of the project can be fully achieved.

Whilst all projects have experienced problems of one form or another it should be pointed out that they have not caused major delays to any of the projects.

3. A good indicator of the extent of the progress which has been made in this Study is the number of scientific papers which have been produced from the research to date. A total of 12 papers have been published which come from research which has been funded as part of this Study. A further 6 papers and 4 technical reports are likely to be produced in the near future. It is expected that many more papers will be published over the next 12 months.

Given the progress which has been made so far it is imperative that additional funds be allocated in the next two years so that the major objectives of this study can be achieved.

Table 2. Summary of the progress of all ecological projects, in the Crown-of-Thorns Study.

Project No.	Project status	Problems	Results	Papers*
1(A)	Laboratory analyses underway	Field	In Progress	No
(B)	Pilot studies unsuccessful	Laboratory	Preliminary	No
(C)	Main objectives achieved	Equipment	Yes	Yes ²
(D)	Experiments being planned	-	No	No
(E)	Preliminary experiments complete	Laboratory	Preliminary	Yes ¹
(F)	Larval cultures successful	Laboratory	Yes	No
(G)	Short term tags developed	Field	Yes	No
(H)	Fieldwork almost complete	Field	Yes	No
(I)	Preliminary study complete	Field	Preliminary	No
(J)	Fieldwork underway	Equipment	Yes	No
2(A)	Field data being analysed	Field/Lab.	Yes	No
(B)	Field data being analysed	Computing	Yes	Yes ¹
(C)	Field samples being analysed	Field	Yes	No
(D)	Field data analysed	Computing	Yes	No
(E)	Field data analysed	Field	Yes	Yes ¹
3(A)	Fieldwork continuing	Field	Yes	No
(B)	Fieldwork continuing	Field	Yes	Yes ¹
4(A)	Analyses nearing completion	-	Yes	No
(B)	Fieldwork completed	Field	Yes	No
(C)	Dispersion analyses underway	Computing	Yes	Yes ²
(D)	Field data being collected	Computing	Preliminary	No
(E)	Non-spatial model complete	Computing	Yes	No
(F)	Catastrophe models underway	Computing	Yes	Yes ³
(G)	System redesigned and constructed	Equipment	Preliminary	No
6(A)	Analyses of field data underway	Laboratory	Yes	Yes ¹
(B)	Field samples being examined	Field	Preliminary	No
(C)	Hydrodynamics complete	Computing	Preliminary	No
(D)	Fieldwork continuing	Field	Yes	No
(E)	Fieldwork continuing	Field	Yes	No
(F)	Model developed	-	Yes	No
(G)	Antibodies being developed	Field/Lab.	Preliminary	No
(H)	Fieldwork continuing	Field	Yes	No

* Value refers to the number of scientific papers produced.

RESEARCH PROPOSED FOR 1987/88

A total of 9 proposals have been received which seek funds to conduct ecologically related research on the crown-of-thorns starfish during the 1987/88 fiscal year. The amount of funds requested by each proposal is given in Table 3. Two of these proposals are new and the research that has been put forward is described in detail in another document (The Crown-of-Thorns Study Reports, 1987). Similarly, the progress of the remaining 7 on-going projects is also reported in this document. The amount of funds which have been requested for 1987/88 are about \$172,000 in excess of the projected estimates which were supplied to the Department of Finance during October last year. These estimates were similar to those proposed in the schedule of funding for ecological projects in the Record of Understanding established between AIMS and GBRMPA.

The proposal put forward by AIMS comprises 24 individual projects which are divided up into 4 structural groups:

1. Dynamics of the starfish.
2. Dynamics of the corals and other reefal communities.
3. Dynamics of the interaction between the starfish and corals.
4. Development of mathematical models and new technologies.

In the past this research programme has utilised approximately 75% of the total funds allocated for ecological projects by the GBRMPA with the remaining funds going to support research conducted outside of AIMS (i.e. external projects). The amount requested for 1987/88 represents about 82% of the projected estimate of expenditure for this period. This proportion has been lower in previous years since AIMS has been able to make considerable savings by not starting certain projects (Projects 2(F) and

2(G): see The Crown-of-Thorns Study Reports, 1985). However, because of the funding restrictions which have been imposed during this year it is unlikely that funds will be carried forward into the next fiscal year. A breakdown of the AIMS budget, by project and also by headings of expenditure, are given in Appendices 1 and 2 respectively.

The information given in these Tables demonstrates that a high proportion of the funds being requested by AIMS (about 62%) is used to pay the cost of salaries. At present, a total of 9 full-time and 2 part-time staff are employed to undertake or assist with research in a number of different projects (see Appendix 1). An additional person is being employed to assist with the administration of the entire Study. It should be pointed out that whilst research staff have been employed for certain projects most of them (particularly the Experimental Scientists) assist with research being conducted in several other projects. As well as employing a number of research staff the AIMS programme is supporting the research activities of two Ph.D. students (Projects 1(G) and 1(J)). It is essential that funds be given in 1987/88 to allow these students to continue with their research.

The information given in Appendices 1 and 2 indicates the large amount of support that AIMS is giving to this programme of research. Much of this is in the form of shiptime or use of facilities, such as computing. In addition, about 15 members of the staff at AIMS (about 34%) are directly involved in undertaking research within the programme. It will be noticed that the financial support given by AIMS is likely to exceed the amount of funds that have been requested for this research in 1987/88. As in all programmes of this magnitude a tremendous amount of organisational support is required to ensure that all projects, including to some extent external

projects, proceed as smoothly as possible. In order to achieve this, approximately 25% of the funds which have been requested for 1987/88 will go towards the administration of the programme. A breakdown of these funds is given in Appendix 3. A description of the major items of expenditure within this area has been given in another document (The Crown-of-Thorns Study Reports, 1987).

Budgets for the remaining 8 research projects (which include 6 on-going projects and 2 new projects) which have been proposed for 1987/88 are given in Appendices 4-11. The total amount of funds requested for this research is \$268,527. Several points can be made concerning the budgets of these projects. They are:

1. Like the AIMS programme a large proportion of the funds for each project is to be used for salaries. About 64% of the total amount of funds requested is to be utilised in this way.
2. The funds requested for Project 6(C) are to cover expenditure for only two months as it will finish at the end of February 1988.
3. The funds requested in Project 6(D) have increased by almost 300% on the figure that was given in the original proposal (December, 1985) for the 1987/88 period. This amount mainly includes additional funds for another Research Assistant, and for travel and vessel charter.

Table 3. List of ecological projects for which COTSAC funds have been requested for the 1987/88 fiscal period.

Chief Investigator	Project No.	Institution/Organisation	Cost (\$)
Lucas	6(A)	James Cook University	25,764
James et al.	6(C)+	James Cook University	5,183
James et al.	*	James Cook University	28,905
Endean and Cameron	6(D)	University of Queensland	61,863
Doherty	6(E)	Griffith University	46,403
Hanna et al.	6(G)	Deakin University	29,959
Fisk	6(H)	Reef Research and Information Services	25,450
Wolanski	*	Australian Institute of Marine Science	45,000
Programme	-	Australian Institute of Marine Science	499,660
TOTAL			768,187

+ to end in February 1988

* denotes new project

CRITERIA FOR THE SELECTION OF ECOLOGICAL PROJECTS

A set of guidelines were developed for the evaluation and selection of those ecological projects which had been proposed for the 1985/86 fiscal year (see The Crown-of-Thorns Study Reports, 1986d). Given that considerable progress has already been achieved in most projects these guidelines can be recast for use in the selection of ecological projects for the 1987/88 fiscal year. Consequently, for projects to be selected it is essential that:

1. They must be directly relevant to the recommendations that were put forward by COTSAC for ecological research in this Study.
2. In the case of new projects, the proposed research must integrate with, and build on present ecological research on the crown-of-thorns starfish.
3. In the case of on-going projects, the research which has been carried out must have shown satisfactory progress.
4. The funds being requested are within the guidelines laid out in the Record of Understanding established between AIMS and GBRMPA.

PRIORITIES IN ECOLOGICAL RESEARCH: RECOMMENDATIONS FOR 1987/88

In view of the fact that the amount of funds requested for research in 1987/88 is a great deal larger than that which is likely to be received, the evaluation and selection process for the forthcoming year is likely to be a more involved and difficult task than those of previous years. Perhaps the most important of the criteria used to select proposals is whether the projects are directly relevant to the recommendations of COTSAC. Unfortunately it is difficult to select proposals on this factor alone as very few specific recommendations (apart from undertaking "priority research") on future ecological research were made by this Committee. This is in contrast to the relatively large number of recommendations that were made in relation to management-related research. In general, those which concerned ecological research can be summarised as follows:

1. To continue surveys of a selected number of reefs using the most appropriate techniques. Also to determine whether a more efficient and precise technique for monitoring starfish and reef condition can be developed (Recommendation 5).
2. To undertake analyses of existing data and modelling studies (Recommendation 8).

Bearing these recommendations in mind and the need to answer many of the important ecological questions identified by COTSAC it is recommended that priority be given to projects which are related to at least one of the following topics:

1. Dispersal and recruitment of Acanthaster.
2. Surveys of the distribution and abundance of starfish and corals.
3. Development of new techniques for surveying the effects of starfish outbreaks.

4. Macro-scale, meso-scale and micro-scale hydrodynamic models.
5. General mathematical models of the phenomenon.
6. The effects of outbreaks on corals and in particular their recovery.
7. Field studies of the ecology of adult starfish.
8. The effects of outbreaks on other reefal communities.

REFERENCES

- The Crown-of-Thorns Study Reports (1985) COTSAC funded research on the ecological aspects of the crown-of-thorns starfish (Acanthaster planci) co-ordinated by the Australian Institute of Marine Science: AIMS projects. Australian Institute of Marine Science: Townsville, December 1985, 160 p.
- The Crown-of-Thorns Study Reports (1986a) Recommendations of Assessment Panel. Australian Institute of Marine Science: Townsville, January 1986, 5 p.
- The Crown-of-Thorns Study Reports (1986b) Proposed allocation of COTSAC funds to ecological projects in 1986/87: Recommendations to Assessment Panel. Australian Institute of Marine Science: Townsville, September 1986, 28 p.
- The Crown-of-Thorns Study Reports (1986c) Progress report on research: 1985/86. Australian Institute of Marine Science: Townsville, September 1986, 25 p.
- The Crown-of-Thorns Study Reports (1986d) Recommendations of Assessment Panel (CISRA) for COTSAC funded ecological research. Australian Institute of Marine Science: Townsville, January 1986, 6 p.
- The Crown-of-Thorns Study Reports (1987) Progress report on research: 1986/87. Australian Institute of Marine Science: Townsville, May 1987, 225 p.

APPENDIX 1

AIMS Study budget for 1987/88: Breakdown (by Project) showing costs to COTSAC and notional costs to AIMS.

Project. No.	Description	Cost (\$)	
		COTSAC	AIMS
1(A)	Geographic patterns in genetic variation of starfish	38,200 ^{1*}	3,320
(B)	Inheritance patterns of isoenzymes	-	2,120
(C)	Field test of the larval starvation hypothesis	66,400 ^{2*}	-
(D)	Vertical orientation and phototaxis of larvae	500	-
(E)	Substrate selection by larvae	500	-
(F)	Development of larvae and juveniles	2,340	-
(G)	Feeding rate of starfish	19,800 +	7,400
(H)	Feeding preference of starfish	1,100	44,700
(I)	Decomposition rates of starfish	-	-
(J)	Ephemeral patches of phytoplankton	11,200 +	21,405
2(A)	Recovery of corals	12,300 *	35,400
(B)	History of disturbance to corals using <i>Porites</i> sp.	800	30,050
(C)	Genetics of coral population fluctuations	2,100	7,300
(D)	Growth and survival of coral remnants	-	14,100
(E)	Effects of outbreaks on fish	1,920	69,700
3(A)	Macroscale surveys of starfish and corals	133,000 ^{4*}	9,000
(B)	Mesoscale surveys of starfish and corals	1,200	19,500
4(A)	Enhancement of substrate reflectance	-	3,440
(B)	Evaluation procedures for verification of Landsat images	27,300 ^{1*}	21,800
(C)	Hydrodynamic models for schematized and actual reefs	7,500	2,500
(D)	Hydrodynamic models of John Brewer Reef	27,000 ^{1*}	140,400
(E)	Models of the dispersal of outbreaks	1,750	42,900
(F)	Analyses and models of outbreaks	28,000 ^{1*}	52,100
(G)	Tagging of starfish	1,000 *	3,200
5(A)	Administration	115,750	-
TOTAL		499,660	530,335

NB. indices denote project includes:

- * Part-time salary
- 1* 1 salary
- 2* 2 salaries
- 4* 4 salaries
- + Postgraduate scholarship

APPENDIX 2

AIMS Study budget for 1987/88: Breakdown (by expenditure heading) showing costs to COTSAC and notional costs to AIMS.

Expenditure Heading	Cost (\$)	
	COTSAC	AIMS
Salaries and Allowances:	321,600	130,030
Travelling and Subsistence:		
Field travel	8,600	1,000
Domestic travel	10,640	-
Overseas travel	2,500	-
Interview and appt expenses	1,500	-
Stores:	15,995	8,000
Freight and Cartage:	1,400	-
Operating Costs of Vehicles:	11,000	-
Charter of Ships:	36,900	221,025
Charter of Aircrafts:	2,200	-
Incidentals:		
Advertising	200	-
Dive ops. and medical	1,000	-
Equip. Hire and Other	500	-
Fringe Benefit Taxes	2,000	-
University Fees	500	-
Bench Fees	6,600	-
Food	1,500	-
Car Rental	400	-
Publications:	500	-
Collaborations:		
Fares and travel costs	2,700	-
Accommodation	500	-
Salaries and On-costs - external	25,000	-
Other external costs	44,550	-
Non-consumable Equipment:		
Computer	500	6,780
Computing Time:	-	163,500
TOTAL	499,660	530,335

APPENDIX 3

AIMS Study budget for 1987/88: Costs associated with administration (referred to as Project 5).

Item	Cost (\$)
Salaries and Allowances:	47,300
Travelling and Subsistence:	
Field	1,000
Domestic travel	3,000
Interview and appointment expenses	1,500
Stores:	1,000
Freight and Cartage:	
Field trips	700
Operational Costs Vehicles:	11,000
Incidentals:	
Advertising	200
Diving Ops and Medicals	1,000
Equipment Hire	500
Fringe Benefits Tax	2,000
University Fees	500
Collaborations:	
Accommodation	500
On-Costs (AIMS):	44,550
Non-consumable Equipment:	
Computer	500
Publications (graphics):	500
TOTAL	115,750

APPENDIX 4

Budget for Project 6(A): (The dynamics of the physiological parameters of high density crown-of-thorns populations: Lucas et al.).

Item	Cost (\$)
Salaries:	
Research Assistant (Mr R. Stump)	14,459
Allowances	985
CPI wage increases	1,500
	16,944
Consumables:	
Chemicals	420
Glassware	1,600
SEM and TEM user time	350
	2,370
Travelling and subsistence:	
Vehicle usage	600
Hire of aircraft and ships:	
Vessel charter (13 days x \$450/day R.V. James Kirby)	5,850
TOTAL	25,764

APPENDIX 5

Budget for Project 6(C): Simulation of the large-scale population dynamics of crown-of-thorns starfish in the Great Barrier Reef System: James et al.).

Item	Cost (\$)
Salaries:	
Research Officer (Mr I. Dight)	4,683
Consumables:	
Computing accessories	500
TOTAL	5,183

APPENDIX 6

Budget for Project 6(D): (Field studies on aspects of the ecology of Acanthaster planci: Endeau and Cameron).

Item	Cost (\$)
Salaries:	
Research Assistant (Grade 1.1)	22,634
Research Assistant (Grade 2.1)	19,777
	42,411
Travelling and subsistence:	
Domestic travel	1,000
Field travel	5,452
	6,452
Consumables:	
Film, telephone, stationary	2,000
Contingencies	1,000
	3,000
Hire of aircraft and ships:	
Vessel charter (2 trips @ \$3,000 each)	6,000
Capital equipment:	
Underwater video (Sony Handicam and flash)	4,000
TOTAL	61,863

APPENDIX 7

Budget for Project 6(E): (Dynamics of recruitment and the densities of juvenile crown-of-thorns starfish between 15°S and 20°S on the Great Barrier Reef: Doherty).

Item	Cost (\$)
Salaries:	
Research Assistant (Grade 1.2)	21,603
Travelling and subsistence:	
Field travel	1,200
Consumables:	
Outboard fuel, tools etc.	600
Hire of aircraft and ships:	
Vessel charter	23,000
TOTAL	46,403

APPENDIX 8

Budget for Project 6(G): (Development of monoclonal antibodies against larvae of Acanthaster planci: A pilot study to detect and characterize larval membrane marker(s) for this species: Hanna et al.).

Item	Cost (\$)
Salaries:	
Research Assistant (Grade 1.3)	20,795
On-costs (8%)	1,664
Consumables:	
Chemicals, laboratory supplies	7,500
TOTAL	29,959

APPENDIX 9

Budget for Project 6(H): (Dynamics of the Acanthaster/Hard Coral Interaction: Fisk).

Project Component	Days required	Costs (\$)
1. Line transects *	7	2,450
2. Coral spat recruitment *	6	2,100
3. Juvenile coral dynamics *	4	1,400
4. Juvenile COT searches *	18	6,300
5. Analysis and reports **	60	13,200
TOTAL		25,450

* Field work (@ \$350/day)

** Office work (@ \$220/day)

APPENDIX 10

Budget for new Project (Investigations of reef-to-reef connectivity using laboratory-hydraulics: Wolanski).

Item	Cost (\$)
Salaries:	
Research Officer	25,000
Capital Equipment:	
Hele Shaw cells, pumps etc...	10,000
Flow visualization and measurement techniques (This includes running costs for the last 6 months evaluated at \$1500)	10,000
TOTAL	45,000

APPENDIX 11

Budget for new Project (Assessment of the Acanthaster phenomenon through a consideration of the life-history strategy of A. planci: James et al.).

Item	Cost (\$)
Salaries:	
Research Officer (Grade 2)	24,013
On-costs and inflation	4,082
Contingencies:	1,000
TOTAL	29,095